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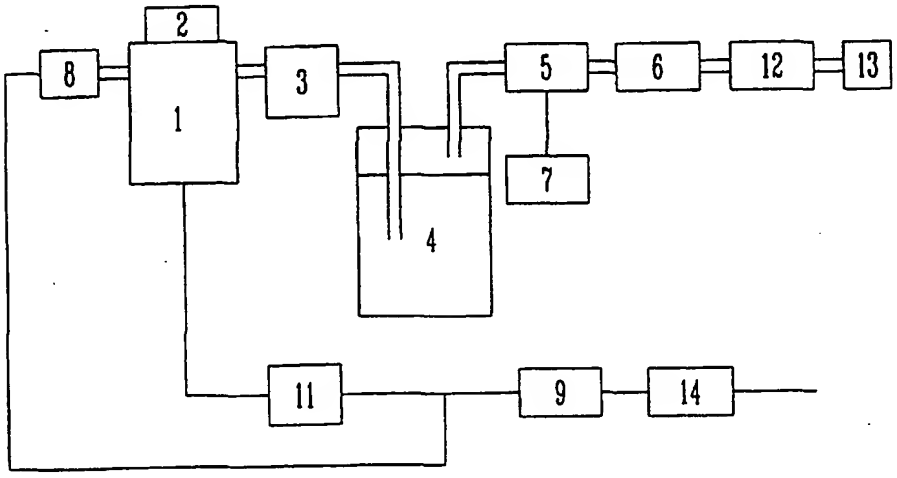

(57) Abstract

Disclosed are an apparatus for electrolyzing water to obtain oxygen and hydrogen gas in a large quantity in a short time, and its method. The inventive water electrolysis apparatus and its method is constructed, including an electrolytic cell having an oxygen and hydrogen generator installed therein and connected to a DC power; a relief valve set in the electrolytic cell, for a pressure control; a demister for filtering impurity of mix gas from the electrolytic cell; a vapor bottle connected to the demister, for performing a spark cut-off in a counterflowing case of gas provided from the demister; a regulator connected to the vapor bottle, for controlling the amount of the gas ejected through a torch positioned on the end thereof; a flash-back arrester connected to the regulator, for preventing the counterflow of the gas; a press switch connected to the electrolytic cell, for switching electric current in response to an interior pressure of the electrolytic cell; and a diode block for converting AC into DC to then couple the DC with the electrolytic cell.

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APPARATUS AND METHOD FOR ELECTROLYZING WATER

TECHNICAL FIELD

The present invention relates to an apparatus and method for electrolyzing water to obtain hydrogen and oxygen gas in a large quantity in a short time, and more particularly, to a water electrolysis apparatus and its method, in which oxygen and hydrogen can be simultaneously obtained in a large quantity through an electrolysis by forming a plurality of positive(+) current and negative(-) current in the inside of the water electrolysis apparatus, thereby utilizing this apparatus in various fields such as home, agricultural, commercial and industrial boilers etc.

BACKGROUND ART

In a water electrolysis, in general, installed in an electrolytic cell are a positive(+) electrode rod in one side thereof and a negative(-) electrode rod in another side thereof. Then, electrolyte is added to and mixed with water, and this is filled in the electrolytic cell. In such state, DC current passes through the electrolytic cell filled with water mixed with the electrolyte to execute the electrolysis. The electrolyte may be dilute

sulfuric acid, sodium hydroxide or potassium hydroxide etc. It was noted that theoretic decomposition voltage is 1.255V in the normal temperature, but substantial voltage required for the electrolysis is appropriated a little higher than the theoretic voltage in consideration of a resistance of the electrolyte and overvoltage for the hydrogen and oxygen.

In a general water electrolyzing method and apparatus above-mentioned, only small quantity of the hydrogen and the oxygen can be gained for a constant time. In order to obtain gas of a large quantity, such several apparatus should be used or a long time should be taken for its electrolysis in this apparatus. Therefore, an art for improving such a shortcoming of the conventional water electrolysis was disclosed in R.O.K Patent No.116005.

In the opened patent above, an apparatus and method for electrolyzing water to get the oxygen and the hydrogen of a large quantity in a short time were disclosed with such a construction that an anode rod was set in the center thereof, cylinders having a cylindric shape, formed as a conductor in a type of several folds were positioned in the neighborhood of the anode rod , on its outmost side a cylindric housing was equipped, and upper and lower support plates formed as the insulation body were fixed in the structure that the cylinders structured in several folds were not in contact with one another, thereby the

apparatus being used, filled with water and electrolyte.

However, in the above electrolysis apparatus, a pressure reducing unit, a transformer, must be generally definitely used, thus the apparatus has a difficulty for a manufacture of a compact size and has a disadvantage for an aspect of an efficiency. It is also a problem which this apparatus does not equip a unit for separating the oxygen and the hydrogen individually and supplying the gas so as to match to each use. Further, there is not equipped a unit for primarily depositing suspended particles etc. contained into the water and the electrolyte, in the inside of the electrolytic cell in this apparatus. That is, the disadvantages in its efficiency are caused.

DISCLOSURE OF INVENTION

Accordingly, the present invention is directed to a water electrolysis apparatus and its method that substantially obviate one or more of the limitations and disadvantages of the related art.

That is, the present invention is provided by improving the conventional apparatus through a large increase of its capacity and efficiency, and through a mechanical compactness thereof.

A primary object of the present invention is to provide an apparatus and method for electrolyzing water

to obtain hydrogen and oxygen gas in a large quantity in a short time, in which a large capacity thereof can be realized by greatly increasing the number of cylinders equipped in a conventional apparatus and a compactness and an efficiency thereof can be achieved by removing a pressure reducing unit of a transformer.

Another object of the invention is to provide a water electrolysis apparatus and its method, in which a plurality of cylindric housings are connected with one another and the oxygen and the hydrogen are extracted and separated from each other in individual cylindric housings.

Still another object of the invention is to provide a water electrolysis apparatus and its method, in which an efficiency in a mechanical performance can be increased by equipping a unit for depositing suspended particles contained into water and electrolyte, in the inside of the electrolytic cell having this apparatus therein.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure as illustrated in the written description and claims hereof, as well as the appended

drawings.

To achieve these and other advantages, and in accordance with the purpose of the present invention as embodied and broadly described, in one embodiment a water electrolysis apparatus capable of providing the oxygen and the hydrogen in a large quantity includes an electrolytic cell having an oxygen and hydrogen generator installed therein and connected to a DC power; a relief valve set in the electrolytic cell, for a pressure control; a demister for filtering impurity of mix gas from the electrolytic cell; a vapor bottle connected to the demister, for performing a spark cut-off in a counterflowing case of gas provided from the demister; a regulator connected to the vapor bottle, for controlling the amount of the gas ejected through a torch positioned on the end thereof; a flash-back arrester connected to the regulator, for preventing the counterflow of the gas; a press switch connected to the electrolytic cell, for switching electric current in response to an interior pressure of the electrolytic cell; and a diode block for converting AC into DC to then couple the DC with the electrolytic cell.

The inventive oxygen and hydrogen generator mentioned above consists of a cylindric housing formed in an outmost side, made of conductive material and connected to negative electrode power; a plurality of cylinders as a

conductor, formed in a cylindric main body; a positive electrode fixation rod, fixed onto a center of the cylinders and connected to positive electrode power; and upper and lower fixation plates made of insulation material, for fixing the cylindric housing, a plurality of cylinders and the positive electrode rod fixation on upper and lower sides thereof. The number of the multiple cylinders preferably has a range from 20 to 22.

In another embodiment of the present invention, in the oxygen and hydrogen generator, a plurality of the cylindric housings are connected with one another, and on their coupled portions, insulation films and separate films are formed in order, after that, it is installed a separator for separating the oxygen and the hydrogen gas from the respective cylindric housings.

The separator is composed of an oxygen extracting module for extracting the oxygen and a hydrogen extracting module for extracting the hydrogen, which are set in the individual cylindric housings; a primary oxygen storage for separating gas and moisture ejected from the oxygen extracting module in the midst of its ejection; a primary hydrogen storage for separating the gas and the moisture ejected from the hydrogen extracting module in the midst of its ejection; a moisture returning module for again returning the moisture separated in the primary oxygen and hydrogen storages to the respective cylindric main body;

and a secondary gas storage for separately storing the oxygen and the hydrogen separated in the primary oxygen and hydrogen storages.

In the invention, further, the oxygen and hydrogen generator is installed in the inside of the electrolytic cell on its upper part by using a fixation rod, and a drain trap is provided in the lower part of the electrolytic cell to drain a foreign substance through an inner side wall of the electrolytic cell and the drain trap, thereby resulting in an increase of a mechanical efficiency.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE ATTACHED DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

Fig. 1 is a general perspective view of an oxygen and

hydrogen generator in one embodiment of the present invention;

Fig. 2 represents electrodes for a partial section of the oxygen and hydrogen generator shown in Fig. 1;

Fig. 3 depicts a block diagram of an apparatus employing an oxygen and hydrogen generator in one embodiment of the present invention;

Fig. 4 offers a general perspective view of an oxygen and hydrogen generator in another embodiment of the present invention;

Fig. 6 shows a detail enlarged view of an electrolytic cell equipping the inventive oxygen and hydrogen generator.

BEST MODE FOR CARRYING OUT THE INVENTION

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

In accordance with the present invention, Fig. 3 schematically shows an apparatus utilizing an oxygen and hydrogen generator, and is constructed mainly by an electrolytic cell 1, a relief valve 2, a demister 3, a vapor bottle 4, a regulator 5, a flash-back arrester 6 etc.

First, the oxygen and hydrogen generator is installed in the inside of the electrolytic cell 1 and is connected

to DC power. A relief valve 2 for a control of a gas pressure is preferably equipped in the electrolytic cell 1, to discharge by a control thereof the gas through this relief valve 2 when an interior pressure of the electrolytic cell 1 becomes more than a specific level. Next, pure water is put into the electrolytic cell 1 and potassium hydroxide aqueous solution as catalyst material of the electrolysis is added thereto, and then, a direct current is applied to generate hydrogen and oxygen gas through this electrolysis.

After that, a demister 3 is connected for the purpose of filtering an impurity from a mix gas of the hydrogen and the oxygen discharged from the electrolytic cell 1. The demister 3 plays a role for filtering the impurity etc. since hydrogen and oxygen gas, and H2O, KOH and the impurity are together ejected through the electrolysis. A vapor bottle 4 is also equipped, being connected to the demister 3 for the sake of a spark cut-off in case the gas from the demister counterflow. This vapor bottle 4 maintains a pressure of a gas ejection constantly, and serves as a role cutting off a spark in a case of an occurrence of the a counterflow phenomenon. This can be also employed for various types of usages by changing solution then changing the temperature of spark and its characteristic.

In order to control the amount of gas ejected from

a torch 12 positioned in an end side of the apparatus, the regulator 5 is connected thereto, and a pressure gauge 7 is provided to always measure a pressure of the electrolytic cell inside and a pressure of a use gas through the torch 12. Further, the flash-back arrestor 6 for preventing a counterflow of the gas is equipped successively with the regulator 5. The torch 12 is then connected next to the flash-back arrestor 6.

It is also desirable to set a press switch 8 in order to switch electric current according to an interior pressure of the electrolytic cell 1.

In nondescribed numbers in Fig. 3, 9 is a fan for cooling the gas, 11 indicates a diode block for converting AC into the DC, 14 shows a circuitry cutting-off part, and 13 represents the torch.

The inventive oxygen and hydrogen generator, as shown in Fig. 1, is constructed by a cylindric housing 30 of an outmost side, a plurality of cylinders 20, 20', 20"..., and a fixation rod 10, and upper and lower fixation plates 40, 40'.

The cylindric housing 30 is made of conductive material and is connected to the negative electrode power.

In this cylindric housing, 20 to 22 cylinders as conductors are continuously disposed radially from a central axial. In a center of these cylinders, the fixation rod 10 connected to the positive electrode power

is equipped. The upper and lower plates 40, 40' fix the cylindric housing 30, numerous cylinders 20, 20', 20"... and the fixation rod of the positive electrode onto its upper and lower sides.

The number in 20 to 22 cylinders enables to realize a large capacity of the apparatus without the construction of a transformer. Accordingly, a loss caused by a pressure reduction of the transformer can be prevented, and also, a curtailment of the cost, a lightness of weight and a compactness of the equipment can be achieved.

In the present invention, a portion of an electrification caused from the positive fixation rod and the positive electrode of the cylinders can be prevented from a corrosion occurring owing to the oxygen from the anode, by plating its stainless steel or steel with nickel.

Fig. 4 indicates a general perspective view of the oxygen and hydrogen generator in another embodiment of the invention.

In Fig. 4, a plurality of the cylindric housings 30, 30', 30",... are joined with one another together, and on their joint portions, insulation films 50 and separate films 60 are formed. Installed also is a separator for individually separating the oxygen and the hydrogen gas from the cylindric housing.

The separator includes an oxygen extracting module

70, a hydrogen extracting module 80, a primary gas storage 90, 90', a moisture returning module 100, 100' and a secondary gas storage 110. The oxygen extracting module 70 and the hydrogen extracting module 80 are installed in each of the cylindric housings 30, 30', 30", ... The primary oxygen storage 90 and the primary hydrogen storage 90' are also each equipped in the invention, including the moisture returning module 100, 100' for separating the oxygen, the hydrogen and the moisture from the oxygen and hydrogen extracting modules 70, 80, temporarily storing them, and returning only the moisture to the cylindric housing 30, 30', 30",... . Further, the secondary gas storage 110 separately stores the oxygen and the hydrogen separated in the primary oxygen and hydrogen storages 90, 90'.

Fig. 5 provides a structure for filtering suspended particles contained into the water and the electrolyte in the electrolytic cell 1. That is to say, the oxygen and hydrogen generator is hung on an upper portion of the electrolytic cell by using a fixation member 120, and a drain trap 130 is formed on a lower part thereof to thus drain the suspended particles through an inner side wall of the electrolytic cell then through the drain trap 130. In such structure, the electrolysis is progressed in the inside of the electrolytic cell 1, minimizing a resistance of the electrolyte, increasing a generation efficiency and

reducing a loss of generation heat caused by a resistance of positive and negative ion. Whereby, though supplementary water led into the electrolytic cell is not surely matched to the perfect pure requirement, an efficiency of the electrolytic cell can be largely improved.

In an inventive method for electrolyzing water and producing oxygen and hydrogen in a large quantity in the electrolysis apparatus, it is required such a structure that 20 to 22 cylinders 20, 20', 20"... made of conductive material are successively disposed in a circular shape; upper and lower faces of the cylinders are fixed by upper and lower fixation plates 40, 40' , or the lower fixation plate 40', made of insulation material; an outer face of such formed body is surrounded by a negative cylindric housing 30; and a positive fixation rod 10 is fixed by the upper and lower fixation plates 40, 40', or the lower fixation plate 40' in a center of the cylinders. In this construction, the generic pure water and the electrolyte are filled in the electrolytic cell 1, and the cylindric housing 30 is connected to the negative electrode power, and the fixation rod 10 is connected to the positive electrode power. In addition, numerous positive and

negative electrode currents are concurrently generated in the cylinders as the conductor set between the fixation rode of the positive electrode and the cylindric housing positioned on the outmost side, to thereby electrolyze the water and obtain the oxygen and hydrogen in a large quantity.

It will be apparent to those skilled in the art that various modifications and variations can be made in the water electrolysis apparatus and its method of the present invention without deviating from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. An apparatus for electrolyzing water to obtain oxygen and hydrogen in a large quantity, comprising:

an electrolytic cell having an oxygen and hydrogen generator installed therein and connected to a DC power;

a relief valve set in the electrolytic cell for controlling a pressure;

a demister for filtering impurity of mix gas from the electrolytic cell;

a vapor bottle connected to the demister, for performing a spark cut-off in a counterflowing case of the gas provided from said demister;

a regulator connected to the vapor bottle, for controlling the amount of the gas ejected through a torch positioned on the end;

a flash-back arrester connected to the regulator, for preventing the counterflow of the gas;

a press switch connected to the electrolytic cell, for switching electric current in response to an interior pressure of the electrolytic cell; and

a diode block for converting AC into DC to then couple the DC with the electrolytic cell.

2. The apparatus of claim 1, wherein said oxygen and hydrogen generator comprises:

a cylindric housing set in an outmost side, made of conductive material and connected to negative electrode power;

a plurality of cylinders as a conductor, continuously disposed radially from the center in a type of several folds, equipped in a cylindric housing;

a positive electrode fixation rod, fixed onto a center of said cylinders and connected to positive electrode power; and

upper and lower fixation plates made of insulation material, for fixing said cylindric housing, a plurality of said cylinders and said positive electrode fixation rod on upper and lower sides thereof.

3. The apparatus of claim 1, wherein the number of said cylinders is within a range of 20 to 22.

4. The apparatus of claim 1 or 3, comprising a separator for separating the oxygen and the hydrogen gas from said respective cylindric housings, in such a structure that a plurality of the cylindric housings are connected with one another, and on their coupled portions,

insulation films and separate films are formed in sequence.

5. The apparatus of claim 4, wherein said separator

oxygen extracting means for extracting the oxygen and hydrogen extracting means for extracting the hydrogen, said oxygen extracting means and said hydrogen extracting means being set in the individual cylindric housings;

a primary oxygen storage for separating gas and moisture ejected from the oxygen extracting means in the midst of its ejection;

a primary hydrogen storage for separating the gas and the moisture ejected from the hydrogen extracting means in the midst of its ejection;

a moisture returning means for again returning the steam separated in said primary oxygen and hydrogen storages to the respective cylindric housing; and

a secondary gas storage for separately storing the oxygen and the hydrogen separated in the primary oxygen and hydrogen storages.

6. The apparatus of one claim out of claims 1 to 5, characterized in that said oxygen and hydrogen generator is installed in the inside of the electrolytic cell on its

upper part by using a fixation member, and a drain trap is provided in the lower part of the electrolytic cell to drain a suspended particles through an inner side wall of the electrolytic cell and said drain trap.

7. The apparatus of one claim out of claims 1 to 6, characterized in that a portion of an electrification caused from the positive fixation rod and the positive electrode of the cylinders is formed by plating stainless steel or steel with nickel.

8. A method for electrolyzing water to obtain oxygen and hydrogen in a large quantity, in such a construction that 20 to 22 cylinders made of conductive material are successively disposed in a circular shape; upper and lower faces of the cylinders are fixed by upper and lower fixation plates, or the lower fixation plate, said upper and lower fixation plates being made of insulation material; an outer face of such cylinders is surrounded by a negative cylindric housing; and a positive electrode fixation rod is fixed by the upper and lower fixation plates, or the lower fixation plate in a center of the cylinders, said method comprising the steps of:

filling up said electrolytic cell with generic pure

water and electrolyte;

connecting the cylindric housing to the negative electrode power;

connecting the positive electrode fixation rod to the positive electrode power; and

generating concurrently numerous positive and negative electrode currents in the cylinders as the conductor set between the fixation rod of the positive electrode and the cylindric housing positioned on the outmost side.

FIG. 1

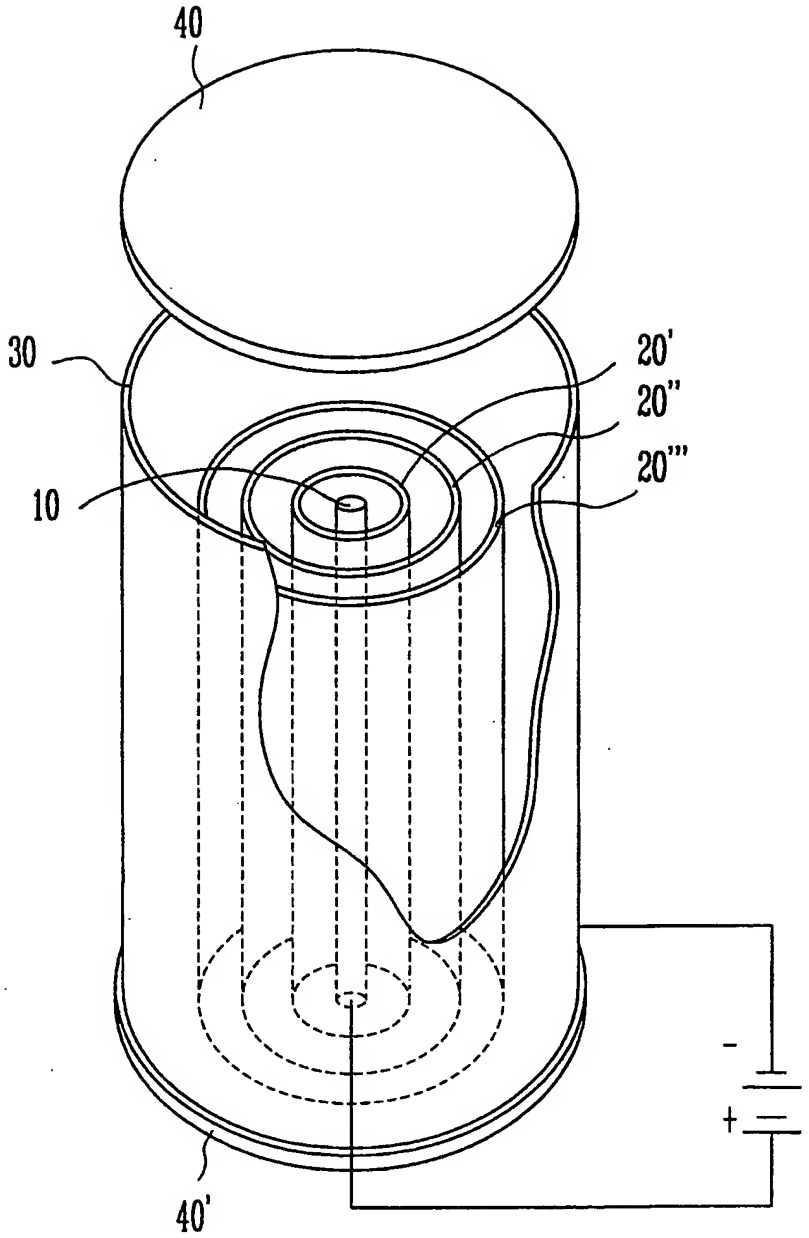


FIG. 2

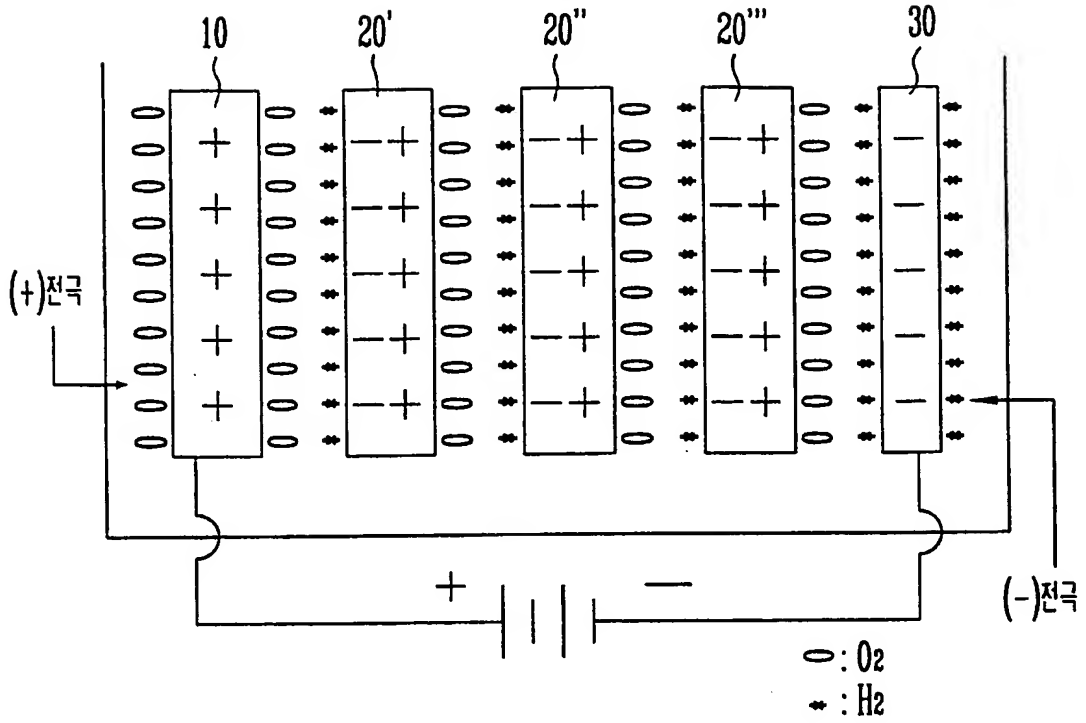


FIG. 3

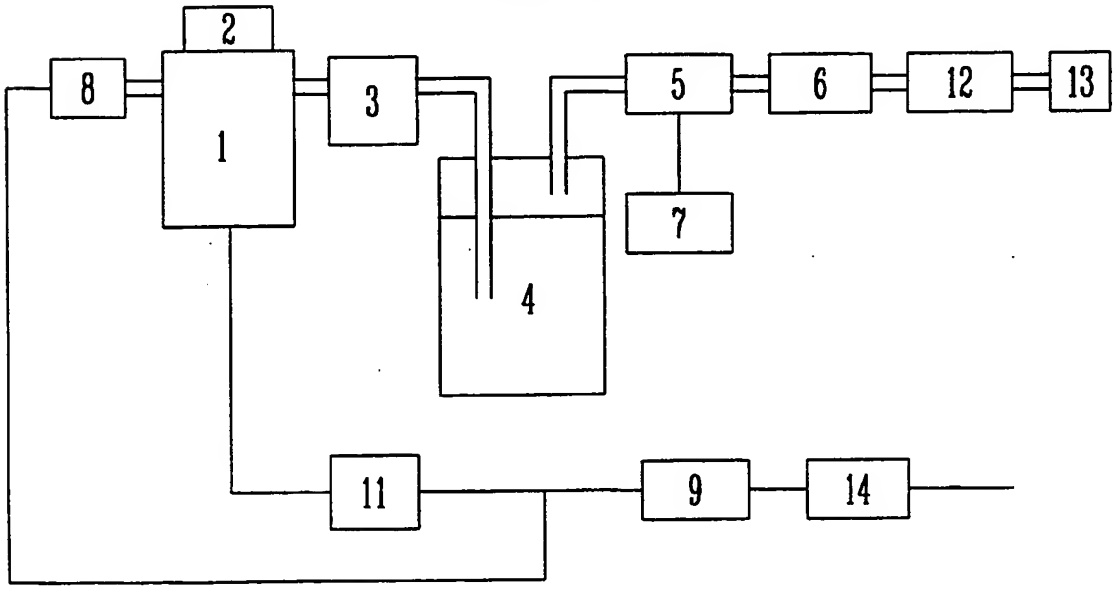


FIG. 4

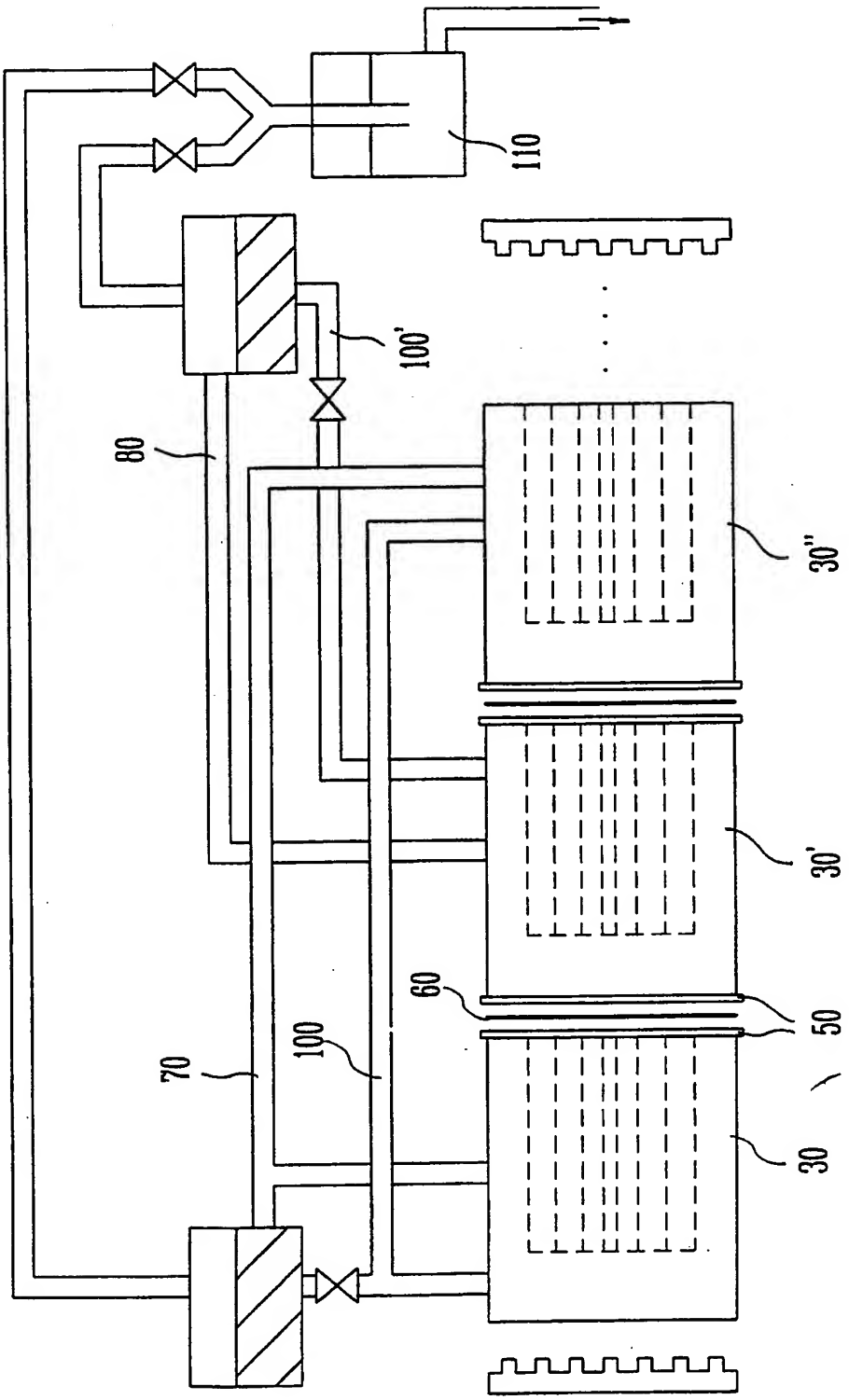
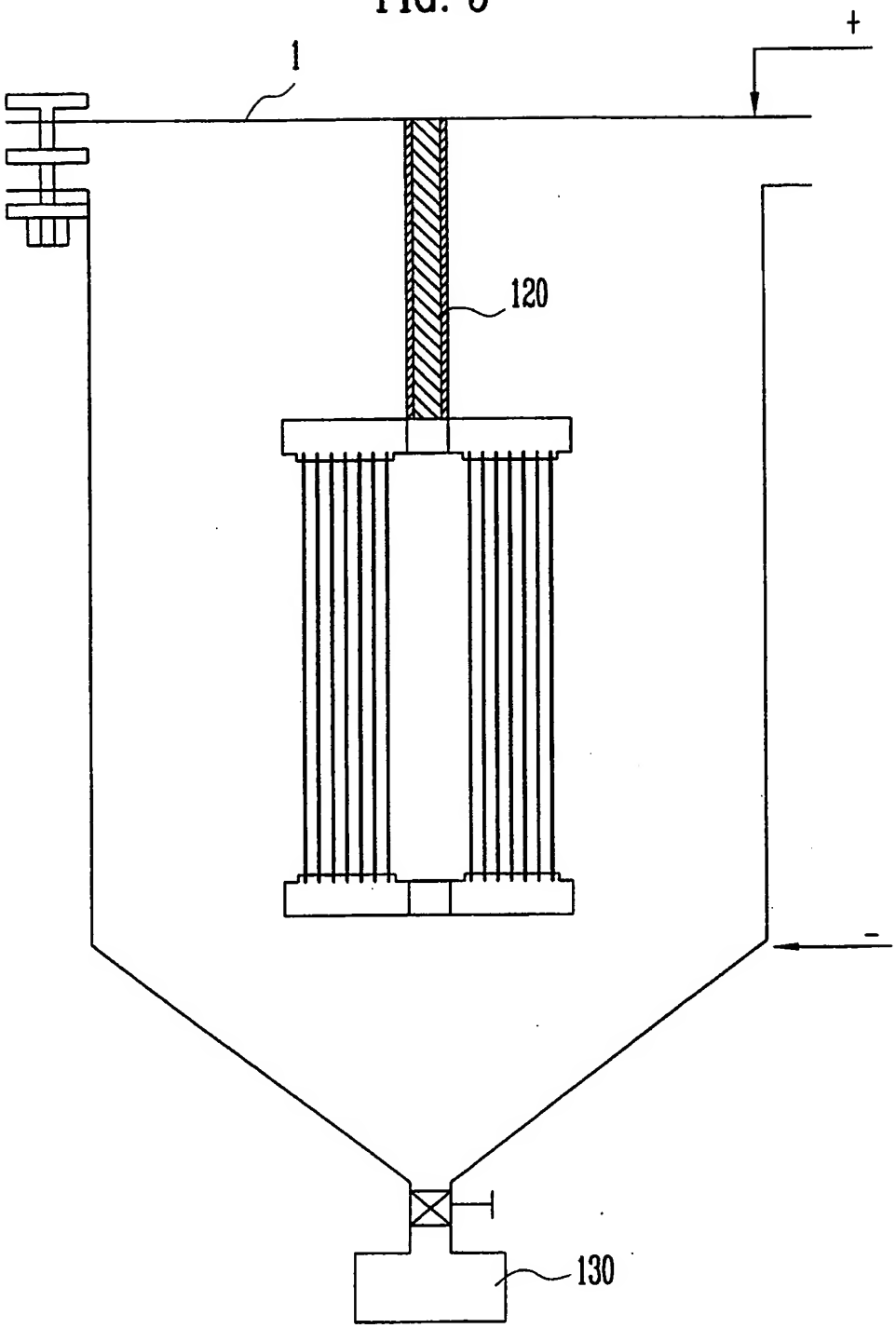


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 99/00206

A. CLASSIFICATION OF SUBJECT MATTER

IPC[7]: C 25 B 1/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[7]: C 25 B 1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO:WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 10-092453 A (FUJI ELECTRIC), 10 April 1998 (10.04.98), abstract.	1-7
A	RU 2086705 C1 (ENERGIYA ROCKET), 10 August 1997 (10.08.97), abstract.	1-7
A	SU 1828879 A1 (DUDIN), 23 July 1993 (23.07.93), abstract.	1-7
A	DE 2159246 A1 (GÖTZ), 14 June 1973 (14.06.73), claims.	8

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR 99/00206

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
JP	A2	10092453	10-04-1998	none	
RU	C1	2086705	10-08-1997	none	
SU	A1	1828879	23-07-1993	none	
DE	A1	2159246	14-06-1973	none	
DE	B2	2159246	08-12-1977		